DOOSAN Document Transmittal Upper Trishuli-1 HEP (216MW)		Date 2022-08-21	DT No.: UT1-HEP-DHI-PC-D-0060	SHEET 1 OF 1
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S. N.	REVIEW NOTE NO.	REVIEW STATUS	DWG. / DOC. NO.	REV.	DWG. TITLE / DOC. DESCRIPTION	REMARK
1	RN-0232	AN	UT1-C-010-CVL-DC-41004/ UT1-C-010-CVL-DG-41001	0B/0A	Stability and Seepage Calculation of Upstream Hard-fill Cofferdam / Embankment Drawing of Upstream Cofferdam	3 SHEET
2	RN-0233	A	UT1-C-845-CVL-DG-70007	0B	Layout Drawing of Monitoring of Main Access Tunnel	1 SHEET
3	RN-0234	A	UT1-C-010-CVL-DC-42003/ UT1-C-010-CVL-DG-42003	0B/0C	Surrounding Rock Stability Calculation of Diversion Tunnel / Excavation and Initial Support Drawing of Diversion Tunnel	1 SHEET
4	RN-0237	A	UT1-C-060-CVL-DG-43002	0A	Excavation and Support Drawing of Work Adit for Steel Penstock Tunnel	1 SHEET
5						
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Received by :

Date :

Legend of Review Status
A : APPROVED
AN : APPROVED AS NOTED
RR : RETURN FOR RESUBMISSION
FI : FOR INFORMATION

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Doosan Enerbility Co., Ltd
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Discipline : Civil

UPPER TRISHULI-1 HEP (216MW)

Client	**Nepal Water and Energy Development Company Private Limited**
Owner's Engineer	**Tractebel Engineering GmbH / Jade Consult**

REVIEW NOTE

Contractor	**Doosan Enerbility**		
Title of the Document	Stability and Seepage Calculation of Upstream Hard-fill Cofferdam/ Embankment Drawing of Upstream Cofferdam		
Document No.	UT1-C-010-CVL-DC-41004/ UT1-C-010-CVL-DG-41001	Revision	0B/ 0A
Date of Documents	16.08.2022	Received Date	16.08.2022
Transmittal Form No.	UT1-HEP-DHI-D-0344		
Previous Review Date/Status	01.03.2022/FI	Prev. Review Note No.	RN-0070
Review Note No.	**RN-0232**	**Present Review Date**	**20.08.2022**
		Present Review Status	**AN**

A: Approved AN: Approved as Noted RR: Returned for Resubmission FI: For Information, only

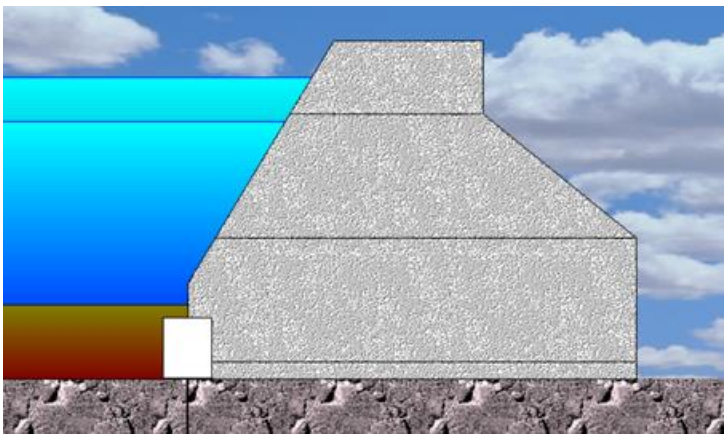
Comments

1. The shear parameter at dam-foundation interface is assumed in Table 3.1 as c=0, f=0.55 (corresponding to the angle of internal friction φ=28.8°). The assumption is acceptable, although it is conservative. However, the Contractor should provide the sources and/or references for the assumption to justify it. In general, the sources of the data used in the calculations should be provided.
2. To Sub-Chapter 3.2.5: The sediment deposit level should be calculated from the original river bed level, but not from the dam-foundation interface.
3. In Table 3.2, the downstream water level is given as El. 1247.17 m for a 5-year flood in whole year and El. 1247.94 m for a 20-year flood in whole year, respectively. These downstream water levels seem not to be at the cofferdam toe. Because the respective upstream water levels are at El.1260.5 and El.1262.3 m, the differences of water level between upstream and downstream amount to 13.33 and 14.36 m within a distance of 12.2 m, which may not be possible. The Contractor should check the downstream water levels at the cofferdam toe.
4. To Sub-Chapter 4.5: The sediment acting on a dam is usually considered in an at-rest state (instead of in an active state, also ref. Clauses 3-7 to 3-10 of EM1110-2-2502) by the resulting structure lateral deformation. Then, the at-rest sediment pressure should be calculated: $p=K_0 h = (1–\sin \phi) h$, where ϕ means the friction angle of sediment.
5. In Table 5.1, the column "hydrostatic pressure" should be split into two columns with "Upstream hydrostatic pressure" and "Downstream hydrostatic pressure" for clarity.
6. To Sub-Chapter 5.2, point 4, the formula for the calculation of factor of safety against floating should be detailed. The force details should be described.
7. To Sub-Chapter 5.3, as a basic criterium no tension shall occur at the upstream and downstream face of cofferdam body and its foundation in the usual load case. For other load

cases, the tension criteria can be taken from Table 4-1 of EM 1110-2-2200 (take care about the units). This should be supplemented in the document and checked.

8. In Table 6.2, the columns “Base bearing stress” should be modified as “base stress” and should be split into the stress at heel and stress at toe. In the heel area, the tensile stress may frequently occur in the unusual and extreme load cases. Different criteria should be applied to the tensile and compressive stresses.

9. In summary, (a). The Engineer performed a checking stability analysis with software CADAM. For the two usual load cases, the results similar to that presented in the document are obtained (with some slightly small safety factors against sliding). Thus, the results presented in the submitted document are considered credible and acceptable.



USUAL COMBINATION1 (STABILITY ANALYSIS)												
Joint		Safety factors					Resultants				Uplift	Rock
		Sliding		Overturning		Uplifting						
ID	Upstream elevation (m)	Peak	Residual	Toward U/S	Toward D/S		Normal (kN)	Shear (kN)	Moment (kN·m)	Position (% of joint)	Final Force (kN)	Passive wedge resistance (kN)
1	1250,000	> 100	> 100	> 100	> 100	> 100	-477,2	0,0	205,4	55,518		
2	1245,000	12,234	5,306	6,698	4,079	5,030	-1579,7	108,4	-772,5	47,124	392,0	0,000
3	1240,000	5,629	2,442	7,176	3,223	4,756	-3234,1	482,1	2820,4	54,818	861,2	0,000
4	1239,282	5,127	2,224	7,235	3,148	4,752	-3470,0	567,9	3389,2	55,396	924,9	0,000
5	Base	3,806	2,520	14,470	5,500	9,503	-3933,2	568,2	1995,5	52,803	462,5	0,000

USUAL COMBINATION2 (STABILITY ANALYSIS)												
Joint		Safety factors					Resultants				Uplift	Rock
		Sliding		Overturning		Uplifting						
ID	Upstream elevation (m)	Peak	Residual	Toward U/S	Toward D/S		Normal (kN)	Shear (kN)	Moment (kN·m)	Position (% of joint)	Final Force (kN)	Passive wedge resistance (kN)
1	1250,000	32,423	14,064	13,900	5,611	8,431	-426,4	11,0	261,7	57,867	57,4	0,000
2	1245,000	6,029	2,615	4,967	2,991	3,747	-1488,9	207,2	-471,7	48,137	542,1	0,000
3	1240,000	3,953	1,715	6,243	2,671	4,088	-3153,1	669,3	3760,8	56,590	1021,0	0,000
4	1239,282	3,704	1,606	6,369	2,627	4,124	-3388,9	767,8	4468,5	57,285	1084,7	0,000
5	Base	2,814	1,863	12,739	4,424	8,249	-3932,0	768,1	2834,2	53,982	542,4	0,000

(b). For the load combinations with a 5-year flood in whole year and with a 20-year flood in whole year, the Contractor should at first carefully check the downstream water levels at the cofferdam toes and set the correct water levels, and then the calculations should be updated. It is expected that the stability of the cofferdam under the two load combinations should be ensured.

10. To Chapter 7: (a). The software AUTOBANK 7 used for the seepage analysis should be approved by the Engineer for the use in this project.

    (b). The calculated uplift pressure at the cofferdam-foundation interface should be read out and compared with that assumed in the stability and floating safety analysis, so as to justify the assumptions.

11. To drawing sheets 2/3 and 3/3: (a). As previously pointed out, the grout-enriched vibrated CSGR may not work with the lean CSGR. During the mix design, relevant construction trial

should be conducted to confirm the feasibility. Otherwise, the Contractor may consider to replace it with the conventional concrete.

(b). In Detail B, a water stop should be installed at the joint between the concrete platform and the hardfill dam.

(c). It is not known to the Engineer why the rubber concrete is used. Its necessity and economy in comparison to the hardfill material should be justified.

(d). Fly ash can be used to produce concrete and CSGR mix.

(e). It may be expected that some transverse flow (or even vortex) may be formed in front of the hardfill cofferdam due to the difference of crest elevation. But this may not affect the stability and serviceability of the cofferdam.

DISCLAIMER

Any approval will not release the Contractor from any of his obligations under the Contract. Despite the Engineer's approval the Contractor remains fully responsible for design, calculation, dimensioning, supply and installation without limitations.

Expert's Name: Dr. Chongjiang Du

Du, Chongjiang

(Signature)